resinous lustre. The specific gravity was 4·98. An analysis by Mr. Blake furnished the following results :—

		Per cent.
Thorium oxide	ThO_2 ...	66·26
Cerium oxide (and Cerium earths) ...	CeO_2 ...	7·18
Zirconium oxide	ZrO_2 ...	2·23
Uranium oxide	UO_3 ...	0·46
Ferric oxide	Fe_2O_3 ...	1·71
Calcium oxide	CaO ...	0·35
Phosphoric oxide	P_2O_5 ...	1·20
Silica	SiO_2 ...	14·10
Water	H_2O ...	6·40
		99·89

This mineral is therefore thorite, consisting chiefly of thorium silicate. Both these minerals are under further investigation at the Imperial Institute. Careful explorations are now being made as to the extent of their occurrence in Ceylon.

It is obvious that apart from the scientific interest attaching to the determination of their composition, the discovery in Ceylon of two minerals rich in thoria, now so largely employed for the manufacture of incandescent gas mantles, may be of considerable commercial importance.

Imperial Institute, March 29. WYNDHAM DUNSTAN.

Ionisation of Air.

SOME experiments have been recently made at the Cavendish Laboratory which seem to throw light on the question of the "spontaneous" ionisation of air. The anticipation of a detailed report of these in a short summary of the results obtained may serve some useful purpose by preventing a waste of energy on the part of others who are engaged in investigating the same subject.

The experiments consist in the determination of the saturation current through rectangular vessels, lined with the metal under investigation, the volume of the vessels being capable of alteration by the motion parallel to itself of one of the sides of the vessel. On plotting a curve the ordinates of which are the saturations currents and the abscissæ the distance of the movable side from the side opposite to it, it becomes clear that there are two separate distinct kinds of radiation causing the ionisation of the gas :—(1) a radiation coming from the sides of the vessel which is completely absorbed by some 5 cm. of air, and which, therefore, when the volume is considerable, gives an ionisation proportional to the surface of the vessel; (2) a much more penetrating radiation, which at all volumes gives an ionisation proportional to the volume of the vessel. Further experiments were then made by surrounding the vessel with lead sheets about 3 cm. thick and repeating the determination of the variation of the ionisation with the volume. The lead screen diminished the ionisation; by this method it was possible to discover which part of the radiation suffered diminution.

Up to the present time four metals have been investigated, lead, aluminium, zinc and tin foil. Of these, in the absence of the screen, the first three gave approximately the same value for the penetrating radiation causing volume ionisation. The absorbable radiation causing surface ionisation was greater for the aluminium than for the zinc, and still greater for the lead. When the screen was applied the penetrating radiation was diminished to about two-fifths of its value for all three metals. In the lead and the aluminium the value of the surface ionisation remained unaltered by the screen, but in the zinc this was decreased, and fell to about three-fifths of its original magnitude.

The tin was quite peculiar in its behaviour. The normal volume ionisation was only about one-third of that in the other metals, and when the screen was applied both the surface and the volume ionisations fell in the same proportion to two-thirds of their former values.

It is pretty clear, therefore, that at least in the case of tin and zinc we have secondary radiation given off from the surfaces of those metals under the influence of penetrating radiation coming from outside.

Some numbers may be useful to give an idea of the respective magnitudes of the radiations mentioned. Taking an arbitrary unit, the values for the ionisation caused by one square centimetre of surface of the metals are as follows :—lead 38·6, tin 33, aluminium 10, zinc 7·9. On the same scale the values of the ionisations due to the penetrating radiation in 1 c.c. of air enclosed in a vessel of these metals is for lead, aluminium and zinc between 3·2 and 2·8; for tin it is 0·9.

It is probable that many of the discrepancies that have appeared between the results obtained by different physicists may be explicable by a difference in the metal of which their vessels were composed. For example, it is clear that it might be possible to detect the effect of a screen on a zinc vessel, while in a lead vessel the diminution of ionisation due to the same screen would be inappreciable; similarly, it would be possible to measure in a lead vessel effects due to the surface radiation which could not possibly be detected if zinc were substituted for the lead. Further experiments on different metals, and with other modifications, are in preparation, which it is hoped will throw more light on this interesting problem.

NORMAN N. CAMPBELL.

Trinity College, Cambridge, March 25.

Respiration in Frogs.

Is the buccal cavity of the frog a respiratory chamber? In a letter to NATURE, March 24, Mr. M. D. Hill accepts this conception of it, and yet the only evidence which can be offered in support of this view is the rich blood supply of its lining membrane. The lungs and skin, which are known to be respiratory surfaces, are supplied by a special circulation; the buccal cavity is neither more nor less supplied with blood than the other parts of the alimentary tract, which are certainly not respiratory.

The oscillatory movement of the frog's pharynx, which occurs when the lungs are filled and the opening to the larynx closed, is one of a number of points connected with the respiratory system which have not yet been satisfactorily explained. The other points are :—(1) the evolution of the reptilian method of respiration from the amphibian; (2) the meaning of the laryngeal and bronchial musculature found in amphibians, reptiles, birds and mammals; (3) the closure of the auditus laryngis of the amphibian during the respiratory phase; (4) the attachment of part of the transversalis and rectus abdominis to the pericardium and roots of the lungs; (5) the air in contact with the respiratory surface of the lungs is always very impure. All these points, with the exception of the last, find their explanation in the fact that the act of respiration in all forms of vertebrate life produces two effects within the lungs :—(1) air is drawn into the air spaces; (2) blood is drawn into the pulmonary capillaries. Further, the rate of flow in the pulmonary capillaries, which are situated in the septa between the air cells, is determined by the pressure within the air cells. The air within the lung is used as a brake for regulating the pulmonary flow of blood. That is to say, the act of respiration in reptiles, mammals and birds has two effects, one on the air and another on the blood within the lung. In amphibians these two effects are apparently obtained by separate means.

In the major movement of amphibian respiration the air is forced within the lungs by the muscles of the pharynx and expelled by the contraction of the muscles of the body wall. In both phases of that movement, which are for the renewal of air within the lung, the pulmonary circulation is retarded by the positive pressure of the breathed air. When the lungs are filled and the opening of the larynx closed, the minor movements set in. They vary in different genera of frogs, but taking the noisy frog (*Rana clamata*) as a type in which to observe these movements, it will be noticed that the body wall muscles, especially the transversalis, contract and rather expand the body at the same time as the larynx is drawn downwards. In all Amphibia the larynx, pharynx, and their muscles are so closely bound up with the lung that the pressure of the pulmonary air must be affected by their movement. In short, the oscillatory movements of the pharynx in the Amphibia (and also in turtles and tortoises) create a negative pressure within the amphibian lung, and thus regulate and accelerate the flow of blood through that organ. For that reason

the larynx is closed in the inspiratory phase, and parts of the transversalis and rectus abdominis are attached directly or indirectly to the pulmonary roots.

Thus parts of the muscles of the amphibian trunk become inspiratory in action, for they contract during the inspiratory phase and tend by their contraction to enlarge the pulmonary space. If, then, the larynx were to be opened in this phase, air would be drawn within the lungs (regulated in its rate of inflow by the laryngeal, tracheal and bronchial musculature), and a thoracic type of respiration would be thus evolved. Thus the minor movements which occur in amphibians when the lungs are filled with air are evidently the precursors of the normal respiratory movements of reptiles, birds and mammals.

One other point in connection with the respiration of the frog may be mentioned; it has not received the attention it deserves. The air which the frog breathes is a mixture of the air just expired with a fresh supply drawn within its mouth. Further, I believe it never empties its lungs completely in expiration. Thus the air within the lungs is always a highly impure air. That is also the case with the air within the pulmonary alveoli of mammals, birds and reptiles. The explanation I offer is that when air breathing vertebrates were evolved from water breathing forms, the oxygen of the atmosphere had to be diluted to a proportion more nearly corresponding with the amount held in water, to which the system of branchial breathing forms were adapted. A. KEITH.

London Hospital Medical College, E.

Degradation of Elements.

A STATEMENT reported as having been made by Sir William Ramsay, that radium breaks down into helium, has been received with a chorus of wonder as something absolutely new. May I point out that in NATURE, October 10, 1889, p. 584, you have something very similar, in an account of some observations on gases in sealed tubes, communicated by the late Prof. Piazzi-Smyth to the British Association in 1889.

The whole of the paper is astounding, stating as it does that many substances break down into hydrogen, but perhaps the most remarkable part is:—"Again, an iodine tube which had a comparatively large quantity of solid iodine granules introduced into, and sealed up in, its interior eleven years ago, and showed then a splendid spectrum of 148 measured iodine lines, extending discontinuously from red to violet, and had nothing else save these very faint, puny images of the three principal lines of hydrogen—this tube, in 1889, has not a single iodine line now left; but its spectrum, which is now brighter than ever, is composed of nothing but hydrogen lines, so that the once solid iodine granules would seem to be partly changed into hydrogen, and partly deposited on the inside of the tube as a yellow haze, besides leaving a trifle of loose dust."

When in 1894 I saw this quoted in Preston's "Theory of Heat," I thought it momentous, and wondered why it had not been followed up and more made.

Some to whom I have mentioned it consider that it comes in the same category as the alleged complete metalepsis of manganese acetate communicated by Wöhler to Liebig's *Annalen*, vol. xxxiii. p. 308. S. H. WOOLHOUSE.

Parmiter's School, Victoria Park, N.E., March 14.

I THINK it was generally believed that Prof. Piazzi-Smyth's results were due to the iodine being absorbed by, and the hydrogen being evolved from, the electrodes. There are many other recorded transformations, among them Dr. Samuel Brown's conversion of carbon into boron (or *vice versâ*, I forget which). The difference between the more recent work and the earlier consists in the fact that the transformation of radium emanation into helium is accompanied by a great energy change, while we do not know that the former supposed transformations are.

Although in all probability the result would be negative, the re-investigation of the old recorded cases is not to be discouraged. WILLIAM RAMSAY.

University College, London.

Remarkable Destruction of Birds in Cardigan Bay.

THE following incident, which has excited much interest here, seems to me to be of more than local interest, and to be worthy of record in the columns of NATURE.

On Friday, March 18, many of my pupils in the Pwllheli County School, on returning from dinner at 2 p.m., informed me that "hundreds and thousands" of birds—starlings, thrushes, blackbirds, woodcock and snipe—had just been cast upon the shore at high tide.

Further, that, during the small hours of the morning, large numbers had fallen "dead beat" upon the deck of a vessel entering the harbour, and also that some had fallen, in a helpless and dying condition, among, and even upon the backs of, workmen employed at the granite quarries on the Gimblet Rock. At first I was naturally somewhat sceptical, but on inquiry in several quarters I found that my informants had correctly stated the case, and that large numbers of birds—all land-birds, be it noted—had been found all along the coast from a point some distance east of the town so far as Aberdaron, several miles to the west. The theories put forward to account for the occurrence were many and varied. Some held that electricity was to be held accountable—either the ordinary atmospheric sort or that uncanny variety manipulated by Mr. Marconi. Others suggested, in all seriousness, a special miraculous intervention of Providence, on the ground that the frost this year had not killed a sufficient number of the feathered tribe!

On the following day I visited the shore with the view of finding some clue to the mystery. I found enough to lead me to believe the following to be the simplest explanation. The warm weather and copious rains of the last few days must have melted large masses of snow on Snowdon and neighbouring ranges. This may have caused in some of the valleys opening out into Cardigan Bay a flood of sufficient magnitude to carry away bushes and trees on the banks of the swollen mountain torrents. Assuming this to have occurred during the night—moonless, starless and possibly foggy—it is conceivable that birds roosting in the branches would cling to them and be carried out to sea. At dawn, finding themselves literally and metaphorically "at sea," the birds would fly hither and thither, and finally sink exhausted. A strong easterly breeze then prevalent would account for the rest. There was, in my opinion, abundant evidence of a flood. In addition to the birds (thrushes, starlings and blackbirds, according to my personal observations) lying about three feet, vertically, above the ordinary high-water mark—the Friday mid-day tide being a spring tide—I found many twigs and a few good-sized branches of alder and willow, besides a branch of a pruned apple tree. Several onions and some cabbages were lying at the same level as the birds, together with a square wicker basket with rope handles. The latter probably indicate a flooded garden, which may enable us later to localise the flood.

The main difficulty to my mind lies in the failure of the birds to leave their drifting perch before getting out to sea. Perhaps some readers of NATURE better acquainted with bird life than myself may be able to throw light on this remarkable occurrence.

C. W. HERBERT GREAVES.

The County School, Pwllheli, N. Wales, March 21.

Distribution of the Nightingale.

THE fact that the distribution of the nightingale is restricted to the drier parts of these islands is well known, but the causes of this are obscure. If an excessive amount of rain be one of them, it is probable that last summer would have had the effect of reducing the number of young birds, and consequently of the immigrants of this spring. I should therefore be much obliged to any of your readers who live in a nightingale country if they will inform me towards May 1 whether they observe any difference in the number of these birds.

I may mention that the nuthatch, a bird which, though not altogether migratory, has a similar range (I have never met with it in North Wales, where I lived many years), has disappeared from here entirely this winter, though it was abundant in former winters. ALFRED O. WALKER.

Ulcombe, Maidstone, March 19.